Chemistry 129
Acids Worksheet

Click on ***halogenated acetic acids***.

1) What is the K_a of acetic acid? Would you classify acetic acid as a strong or as a weak acid? (K_a>10 for a strong acid).

$K_a = 1.74 \times 10^{-5}$ $K_a << 1$ Acetic acid is a weak acid.

2) Write down the K_a expression. Move the bar with the initial concentration from 0.001M to 10M. How does the % dissociation change? Does this make sense when you consider the K_a expression?

$K_a = \frac{[C_2H_3O_2^-][H_3O^+]}{[HC_2H_3O_2]}$

* The pH of the solution decreases with increasing $[HA]_{initial}$ because $[H_3O^+]_{equil.}$ increases
* The % dissociation decreases with increasing $[HA]_{ini}$

* If we dilute a weak acid solution originally @ equilibrium, the system (according to Le Chatelier's principle) responds to minimize the disturbance. Thus, the equilibrium shifts to the right because the right side contains more particles in solution. $HA_{(aq)} \rightleftharpoons H^+_{(aq)} + A^-_{(aq)}$ (1 mol → 2 mol) So, % dissociation is greater in a more dilute solution.

3) Record the K_a values for monofluoro, difluoro and trifluoroacidic acid by clicking on one ***H*** after the other. What are the trends?

acid	K_a
CH_2FCOOH	2.19×10^{-3}
CHF_2COOH	5.75×10^{-2}
CF_3COOH	5.89×10^{-1}

As the number of F atoms increases, the strength of the acid increases.

4) Click on all the ***F*** and turn them into ***Cl***. What is the K_a of trichloroacidic acid? Is trichloroacidic acid weaker or stronger than trifluoroacetic acid? Click on the ***Cl*** and turn them into ***H*** and record the K_a for dichloroacetic acid and monochloroacetic acid.

acid	K_a
$CH_2ClCOOH$	1.38×10^{-3}
$CHCl_2COOH$	5.13×10^{-2}
CCl_3COOH	2.24×10^{-1}

5) Summarize the general trends for these acetic acid derivatives.

As the number of more electronegative atoms increases, the strength of the acid increases.

6) Go back to the menu and click on ***Inorganic Oxyacids***. Take a ***Cl*** and put it in the place for the central atom. Add an ***OH***, record the name and the K_a of the acid. Add three ***O*** one after the other and record the names and the K_as.

Formula	Name	K_a
ClOH	hypochorous acid	2.95×10^{-8}
OClOH	chlorous acid	1.05×10^{-2}
O_2ClOH	chloric acid	1.00×10^{3}
O_3ClOH	perchloric acid	1.00×10^{10}

7) Clear the acid and put ***S*** in the place for the central atom. Add two ***OH*** groups and one ***O***. Record the name and the K_a for the acid. Add another ***O*** to the acid. Record the name and the K_a.

Formula	Name	K_a
H_2SO_3	sulfurous acid	1.26×10^{-2}
H_2SO_4	sulfuric acid	1.00×10^{3}

8) Put ***P*** in the place of the central atom and replace one ***O*** with ***OH***. Record the name and the K_a.

Formula	Name	K_a
H_3PO_4	phosphoric acid	7.11×10^{-3}

9) Make ***N*** the central atom, and take away two ***OH***. Record the name and the K_a of the acid. Add one ***O*** and record the name and the K_a of the acid.

Formula	Name	K_a
HNO_2	nitrous acid	5.13×10^{-4}
HNO_3	nitric acid	2.00×10^{1}

10) Based on the data above, how many oxygens without hydrogen are necessary to make an acid a strong acid?

Two oxygen atoms without hydrogen are needed to make an acid strong.